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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/867,611	05/31/2001	Tatsuya Iwasaki	35.G2364 DI	8042

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EXAMINER

ZARNEKE, DAVID A

ART UNIT	PAPER NUMBER
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2827

DATE MAILED: 02/13/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/867,611

Applicant(s)

IWASAKI ET AL.

Examiner

David A. Zarneke

Art Unit

2827

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 26-50 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 26-36 is/are allowed.
- 6) ☒ Claim(s) 37-39, 41-47, 49 and 50 is/are rejected.
- 7) ☒ Claim(s) 40, 48 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 May 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. 09/276,667.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 9.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 37, 39, 41, 43, 44 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admitted prior art in view of Konuma et al., US Patent 5,959,638.

Applicant's admitted prior art teaches the forming of nanoholes in an aluminum substrate through the use of anodization (Specification, page 2, line 17+).

Applicant's admitted prior art fails to teach the anodizing step as including a 1st process in which the anodization current is a steady state value and a 2nd process in which the anodization current decreases after said 1st process and wherein both processes occur consecutively.

Konuma teaches a prior art method of making a semiconductor device utilizing anodic oxidation comprising anodizing a metallic substrate, such as aluminum (1, 29+), by maintaining the current at a constant value for a certain period of time and then decreasing the current flow (Figure 1 & 1, 39+).

While Konuma does not teach forming nanoholes in the aluminum substrate, and even teaches away in that it teaches forming an anodic oxide using a neutralized solution with a pH of 7 (2, 37+), Konuma does teach that the process used controls the

film thickness in the initial process (1, 51+) and then improves the uniformity of the film thickness and quality in the 2nd process step (1, 59+). Since thickness control, and uniform thickness and quality is important for both anodic oxidation and anodic nanohole formation, one of ordinary skill in the art would find it obvious to use the improvements of Konuma in the Applicant's admitted prior art.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use the process of Konuma in Applicant's admitted prior art because of this improved control over the thickness and the improved uniformity of the film thickness and quality (1, 59+).

Regarding claim 39, Konuma teaches that anodization terminates after the current decreases to a final value equivalent to about 1 tenth of the current maintained through the constant-current state (1, 63+).

With respect to claim 41, Applicant's admitted prior art teaches the nanoholes as passing completely through the anodized film to the surface of the underlying silicon (Specification, page 5, lines 19+).

As to claims 43 and 44, the forming of different regions of electrical resistivity and regions where the nanohole passes through the anodized film and where it does not pass through the anodized film are both obvious matters of design choice. Design choices and changes of size are generally recognized as being within the level of ordinary skill in the art (MPEP 2144.04(d)).

Regarding claim 46, the growing of a carbon nanotube in the nanohole is a conventional next step in the forming of a nanostructure. The use of conventional

materials to perform there known functions in a conventional process is obvious. In re Raner 134 USPQ 343 (CCPA 1962).

Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admitted prior art in view of Konuma et al., US Patent 5,959,638, as applied to claims 37 and 39 above, and further in view of Daimon, JP 63-187415.

Applicant's admitted prior art and Konuma both fail to teach the enlarging of the diameter of the nanohole.

Daimon teaches a method of making a magnetic medium comprising anodizing an Al surface followed by increasing the diameter of the pores using electrolysis (7, 15+).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the pores enlargement technique of Daimon in the combined inventions of Applicant's admitted prior art and Konuma because Daimon teaches that this enlarged diameter is used to deposit a magnetic material in the increased diameter pores (7, last paragraph).

Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admitted prior art in view of Konuma et al., US Patent 5,959,638, as applied to claim 37 above, and further in view of Masuda et al., US Patent 6,139,713.

Applicant's admitted prior art and Konuma both fail to teach the forming of a recessed portion in the film prior to performing the anodization step.

Masuda teaches the forming of recessed portions in a substrate prior to performing anodization.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the recessed portion of Masuda in the combined inventions of Applicant's admitted prior art and Konuma because Masuda teaches that the roundness of the pores and the uniformity of the pore size are improved (abstract).

Claim 38 is rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admitted prior art in view of Konuma et al., US Patent 5,959,638, and Daimon, JP 63-187415.

Applicant's admitted prior art teaches the forming of nanoholes in an aluminum substrate through the use of anodization (Specification, page 2, line 17+).

Applicant's admitted prior art fails to teach the anodizing step as including a 1st process in which the anodization current is a steady state value and a 2nd process in which the anodization current decreases after said 1st process and wherein both processes occur consecutively.

Konuma teaches a prior art method of making a semiconductor device utilizing anodic oxidation comprising anodizing a metallic substrate, such as aluminum (1, 29+), by maintaining the current at a constant value for a certain period of time and then decreasing the current flow (Figure 1 & 1, 39+).

While Konuma does not teach forming nanoholes in the aluminum substrate, and even teaches away in that it teaches forming an anodic oxide using a neutralized solution with a pH of 7 (2, 37+), Konuma does teach that the process used controls the film thickness in the initial process (1, 51+) and then improves the uniformity of the film thickness and quality in the 2nd process step (1, 59+). Since thickness control, and

uniform thickness and quality is important for both anodic oxidation and anodic nanohole formation, one of ordinary skill in the art would find it obvious to use the improvements of Konuma in the Applicant's admitted prior art.

Applicant's admitted prior art and Konuma both fail to teach depositing a film on a surface of the Al film containing a noble metal, MN, Fe, CO, Ni, Cu and C.

Daimon teaches the use of an under layer for the AL layer containing a noble metal or CU (page 6, last paragraph).

Regarding claim 47, Konuma teaches that anodization terminates after the current decreases to a final value equivalent to about 1 tenth of the current maintained through the constant-current state (1, 63+).

With respect to claim 49, Applicant's admitted prior art teaches the nanoholes as passing completely through the anodized film to the surface of the underlying silicon (Specification, page 5, lines 19+).

As to claim 50, Daimon teaches anodizing an Al surface followed by increasing the diameter of the pores using electrolysis (7, 15+).

Allowable Subject Matter

Claims 40 and 48 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: Prior art could not be located that taught returning the current to the steady

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state value after the 2nd process and then terminating the anodization at this point. This limitation, in conjunction with the other claim limitations, was neither disclosed in, nor suggested by, the prior art.


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David A. Zarneke whose telephone number is (703)-305-3926. The examiner can normally be reached on M-F 10AM-6PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David L. Talbott can be reached on (703)-305-9883. The fax phone numbers for the organization where this application or proceeding is assigned are (703)-308-7722 for regular communications and (703)-308-7721 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)-308-0956.

David A. Zarneke
February 10, 2003


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